RENSSELAER OBSERVATORY PUBLICATIONS

Number 15

18-Megacycle Cosmic-Noise Intensities

1959 December 1 to 1960 January 31

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INTRODUCTION

The Data

Apparatus for measuri g the changes in intensity of 18-megacycle cosmic noise received from the sky has been set up at the Sampson Station of the Observatory of Rensselaer Polytechnic Institute The position of the equipment is latitude 42° 47' North, longitude 73° 27' West. The purpose of the program is to detect the occurrence of solar flares indirectly by the associated effect on the transmission properties of the ionosphere. The effect is to decrease suddenly the transmissivity of the ionosphere to produce a sudden cosmic-noise absorption (SCNA), examples of which may be seen on the succeeding pages of this paper. The apparatus responds in a somewhat similar fashion to several other effects, particularly auroral activity. At times of solar disturbance there are in addition a number of increases of incoming radiation which we believe to be solar in origin. In what follows these are referred to as bursts

This is a continuation of the records of 18-megacycle cosmic-noise intensity published in ROP 1. The same receiver is in use. The antenna, however, was rebuilt on June 19, 1958 to the same characteristics as the former one. The new antenna consists of tubular twin-lead instead of the former open lines, and its performance is presumably more independent of moisture conditions.

On the pages which follow we show reproductions of the recorder tapes, one week on a page. The original tapes move at four inches per hour. The reduction for the photographs here is very closely 1 to 12. Times are given in Universal Time.

It should be noted that the receiver response is rapid when the signal decreases, but slow when an increase occurs. Thus the record of a burst gives only an approximation to the rate of rise and maximum value attained, but generally not the true values. The times of beginning and the duration, however, are significant.

The vertical markers every ten minutes are produced by a separate receiver tuned to station WWV at 5 megacycles. The amplitude of these markers during a solar disturbance is very rough indication of the field strength of the 5-megacycle signal as received at the Sampson Station.

activity, on the other hand, shows a slower decrease of intensity, and usually a more rapid rise, resulting in a more symmetrical curve. Such events are often repeated a number of times during a single night, with varying values of maximum absorption. There are occasionally isolated daytime events in which the decrease in intensity is slow; we refer to these as "slow SCNA's."

The bursts generally show a fast onset, limited by the time constant of the receiver for increasing signals, and a short duration. Because of the time constant, the maximum intensity recorded may be considerably less than the true maximum intensity. The time of beginning and the duration are, however, significant. Often the bursts occur in groups. Noise storms on the sun may show on the records as a series of superimposed bursts, giving a highly variable trace.

Calibration

On most days two two-point calibrations are recorded, usually at about 0100 and 1100 U.T., for the purpose of checking receiver stability. The lower, "cold," step is produced by substituting a cold resistor for the antenna and indicates the receiver noise level. The upper, "hot," step is an arbitrary level approximately equal to the maximum level of incoming cosmic noise. In addition, a daily step calibration shows 3-decibel steps ($V_n^2/V_{n+1}^2 = 0.5$) from the same "hot" level, called 0 db. The steps are produced by feeding known voltages from a signal generator into the receiver. The lowest step is the "cold" calibration rather than a known input signal. The changes from day to day are small, but sufficient to make the scale at the left of the charts only approximate. Note the non-linearity of the scale.

The Comments

On the pages facing the reproductions are lists of events and comments about the records. In the comments, certain numerical indications of importance and intensity are given. For SCNA's the "class" is a measure of importance on a rising scale of 1- to 3+, determined by amplitude and duration. The percentage of absorption is the intensity ratio of the least cosmic noise received during the event to the noise which would have been received if the event had not occurred.

In some cases, a rise or fall of the recorder pen can be identified with a disturbance caused by operation or testing of other equipment in or near the building in which the 18-megacycle receiver is located. Such a rise or fall is identified as "interference." In some cases it is suspected rather than established. "b" means before.

Beginning January 1, 1960 the comments will include the Geophysical Alerts and Special World Intervals which are issued by the World Warning Agency of the Internations' World Day Service.

Acknowledgements

During the interval covered in this report, the equipment was under the care of the following observers:

Justin A. Curtis
Ralph Haskell
Masakazu Oshima

We are indebted to William Adair and Raymond Falconer for the photography of the strip charts, and to Mrs. Cassie Young for the typing of the tables and text.

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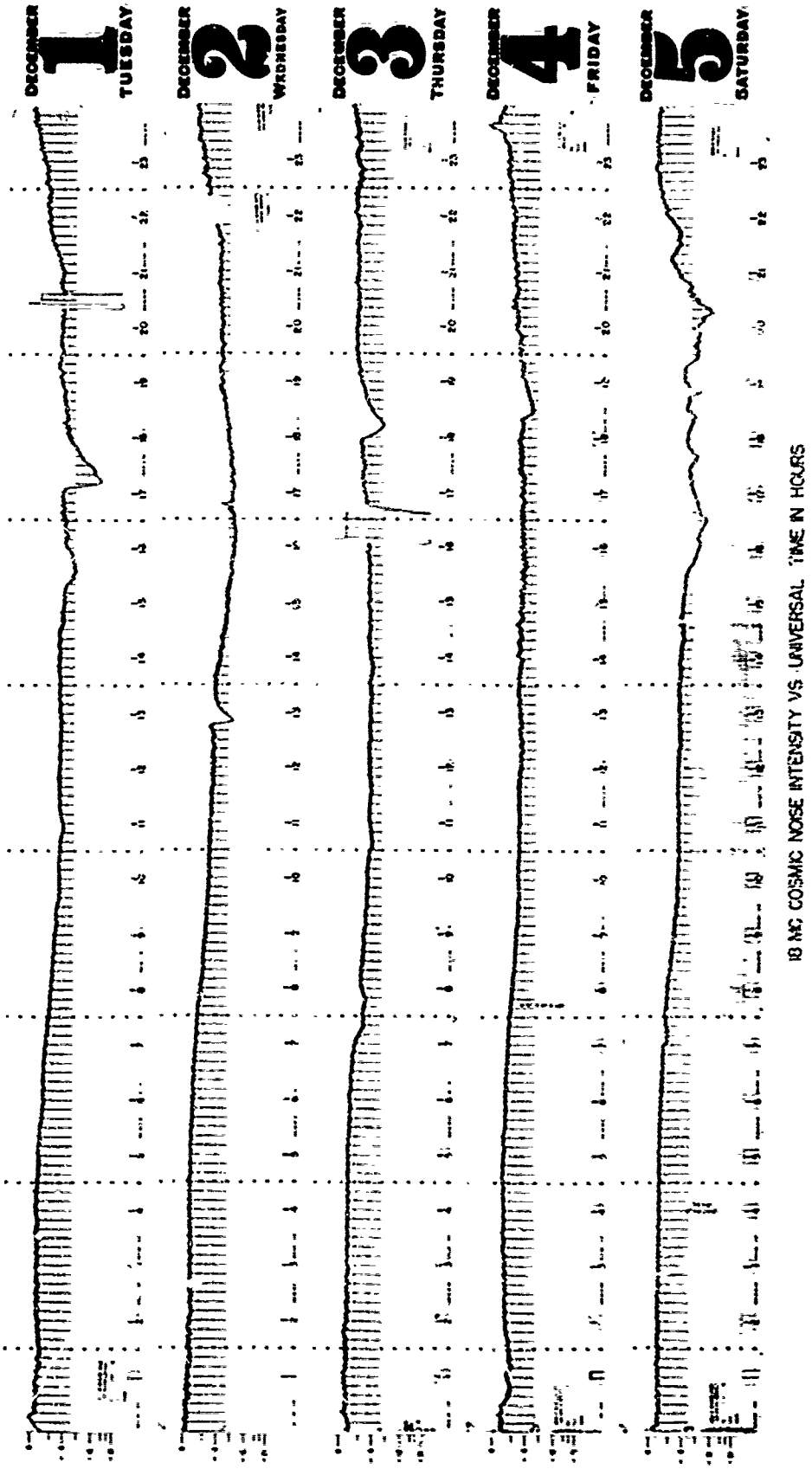
Erratum

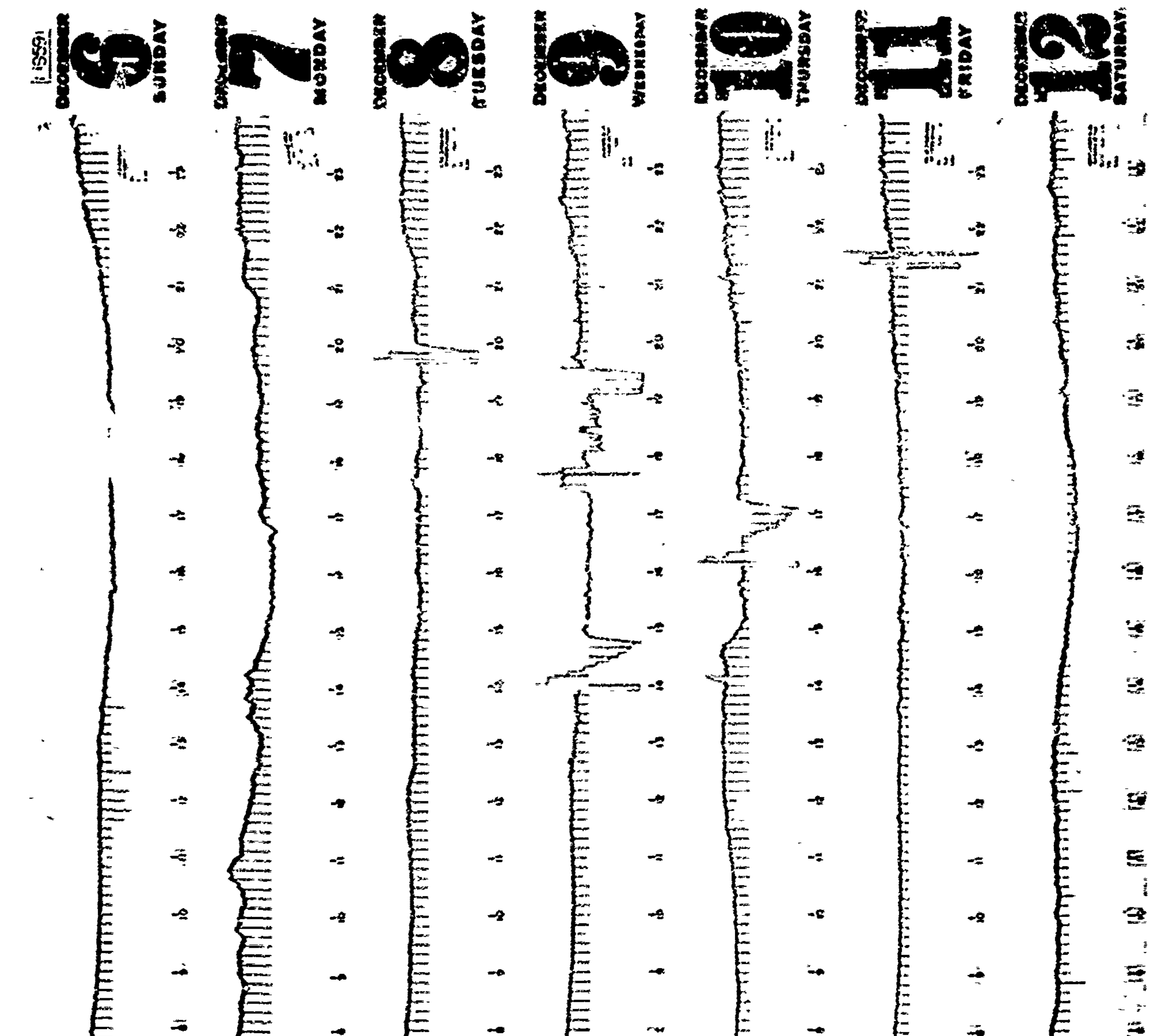
ROP 14, page 8, November 21, 1959
Insert time, 1620-1720, in front of comment.

1959

December 1	1705 - 1820	SCNA, class 3, 69% absorption.
December 2	1248 - 1318	SCNA, class 2, 49% absorption.
	1644 - 1649	Burst.
December 3	1756 - 1910	SCNA, class 2, 49% absorption.
December 4	1820 - 1906	SCNA, class 1, 30% absorption.
December 5	1530 - 2206	Absorption, possibly caused by daytime aurora, during IGY alert. 64% maximum absorption.

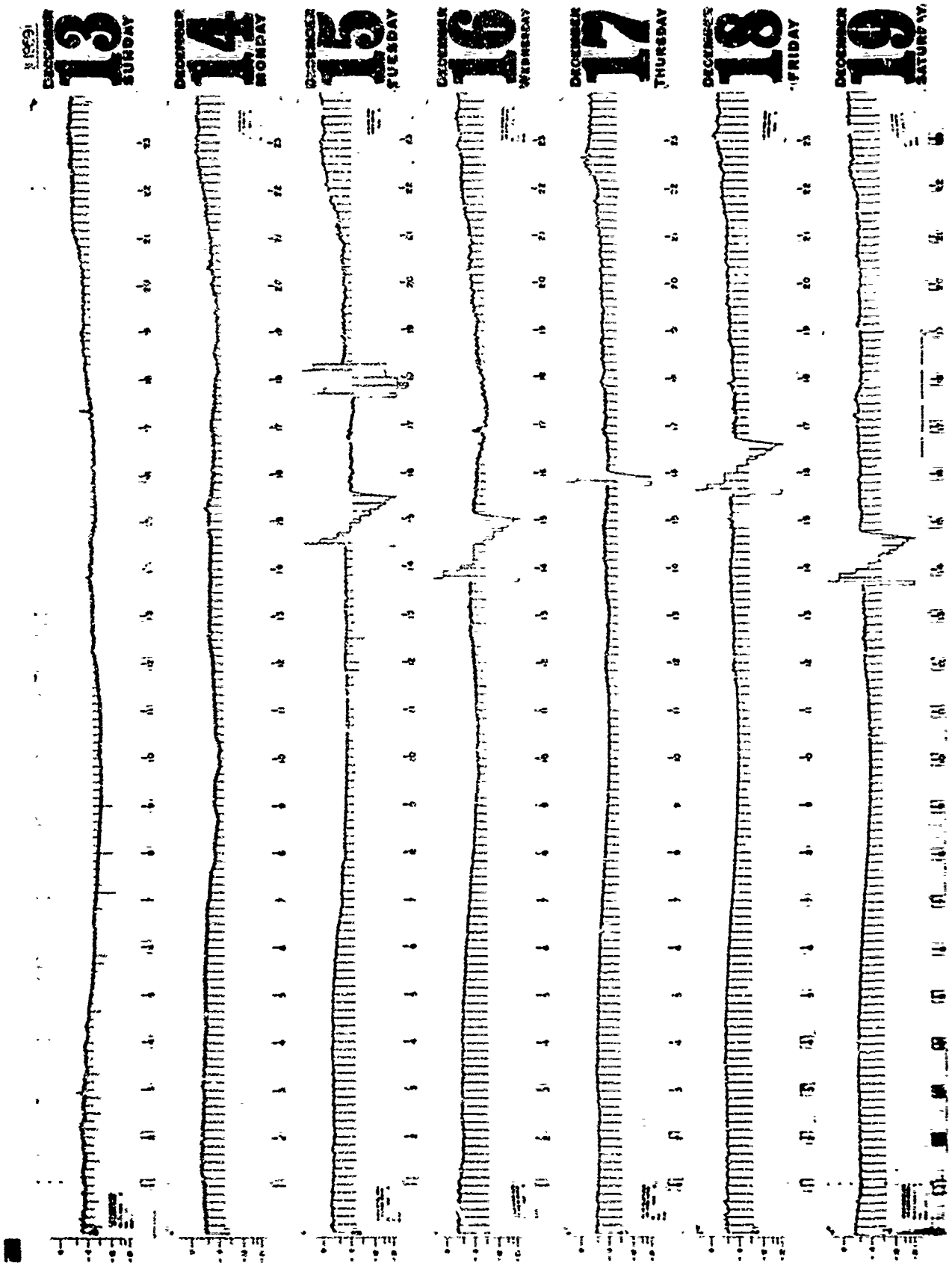

DECEMBER 1 TUESDAY
DECEMBER 2 WEDNESDAY
DECEMBER 3 THURSDAY
DECEMBER 4 FRIDAY
DECEMBER 5 SATURDAY
18 MC COSMIC NOISE INTENSITY VS UNIVERSAL TIME IN HOURS

1959		
December 6	No comments.	
December 7	0242 - 2115	Variability correlates with precipitation and electric activity.
December 8	No comments.	
December 9	1722 - 1932	Equipment adjustments.
	2120 - 2400	Rise in level due to failure of heating equipment.
December 10	0000 - 1444	Unusually high level due to failure of heating equipment.
	1404 - 1410	Burst.
	1444 - 1510	Fall in level due to gradual warming up of equipment.
	2104 - 2110	Burst.
December 11	2135	Recorder zero point adjustment.
December 12	0613 - 0710	Variation in level correlates with atmospheric electricity.



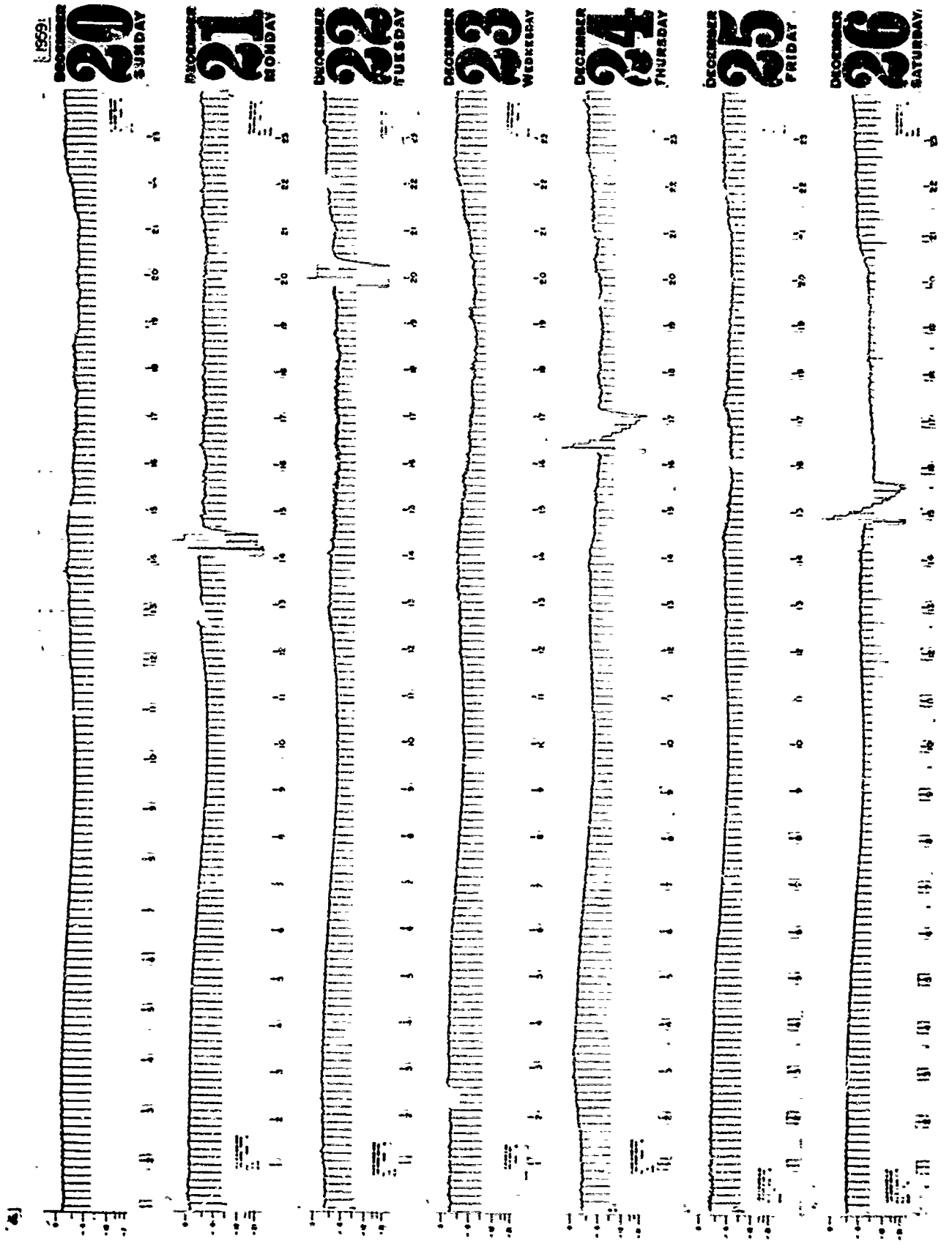
18 MC COSMIC NOISE INTENSITY VS UNIVERSAL TIME IN HOURS

1959		
December 13	0250 - 0258	Peak, cause unknown.
	1728 - 1733	Burst.
December 14	No comments.	
December 15	1753	Recorder zero adjustment preceded and followed by hot-cold calibration.
	2100	Burst.
	2110	Burst.
December 16	1651 - 1659	Burst.
December 17	2215 - 2245	Bursts.
December 18	1450 - 1510	Bursts.
	1650 - 1710	Bursts.
	1750 - 1757	Burst.
December 19	1710 - 1717	Burst.


DECEMBER 13 SUNDAY
DECEMBER 14 MONDAY
DECEMBER 15 TUESDAY
DECEMBER 16 WEDNESDAY
DECEMBER 17 THURSDAY
DECEMBER 18 FRIDAY
DECEMBER 19 SATURDAY
COSMIC NOISE INTENSITY VS UNIVERSAL TIME IN HOURS

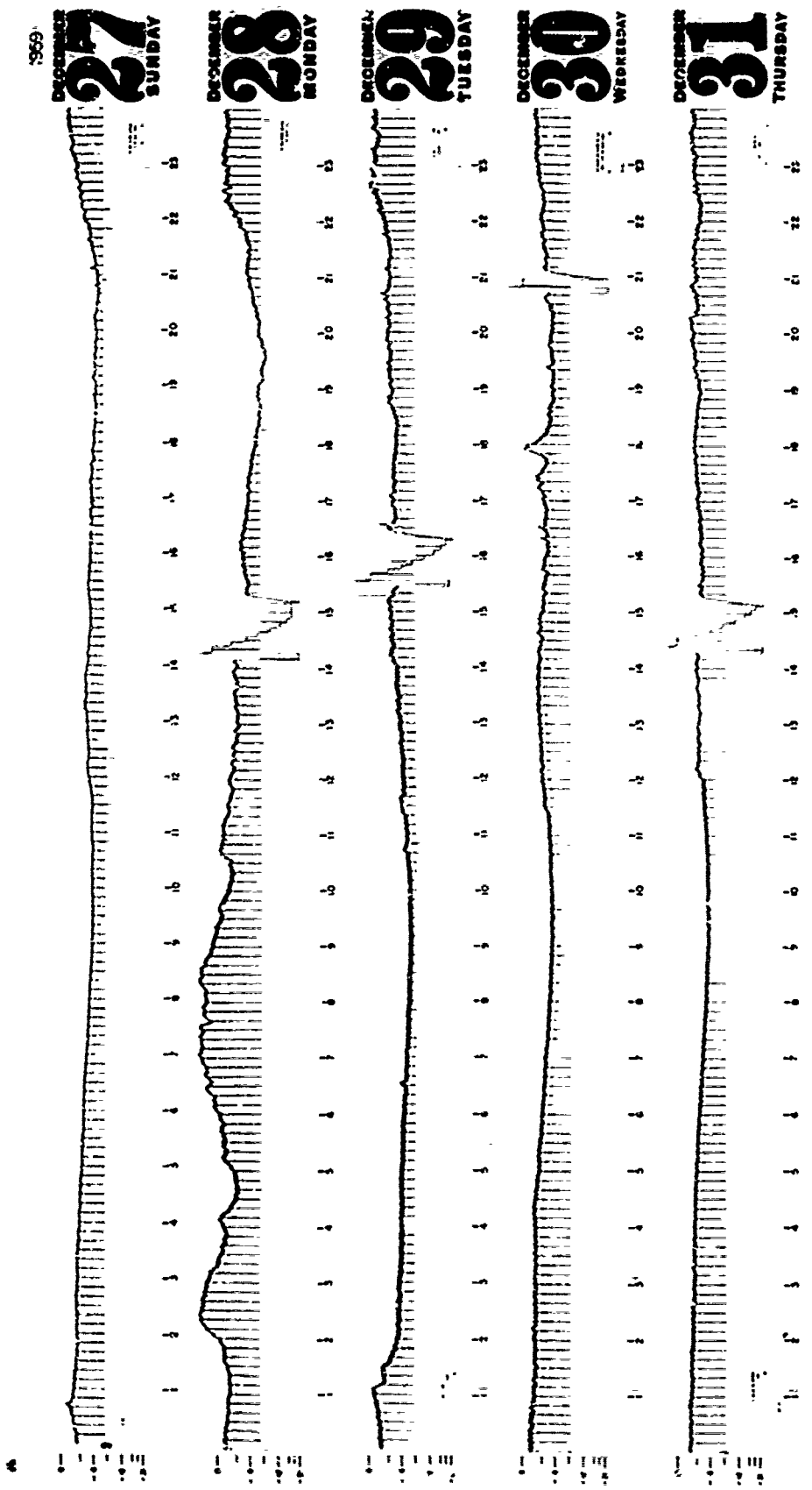
1959

December 20	Note that the trace for this day begins at 0100 UT, not 0000 UT as usual. Some ten-minute marks are farther apart than normal.	
	1344 - 1350	Bursts.
December 21	1230 - 1238	Burst.
	1450 - 1730	Variable.
December 22	1358 - 1852	Variable.
December 23	1759 - 1810	Bursts.
	1905 - 1920	Bursts.
December 24	2007 - 2400	Variable.
December 25	No comment.	
December 26	No comment.	


1959
DECEMBER 20 SUNDAY
DECEMBER 21 MONDAY
DECEMBER 22 TUESDAY
DECEMBER 23 WEDNESDAY
DECEMBER 24 THURSDAY
DECEMBER 25 FRIDAY
DECEMBER 26 SATURDAY
18 MC COSMIC NOISE INTENSITY VS UNIVERSAL TIME IN HOURS

1959

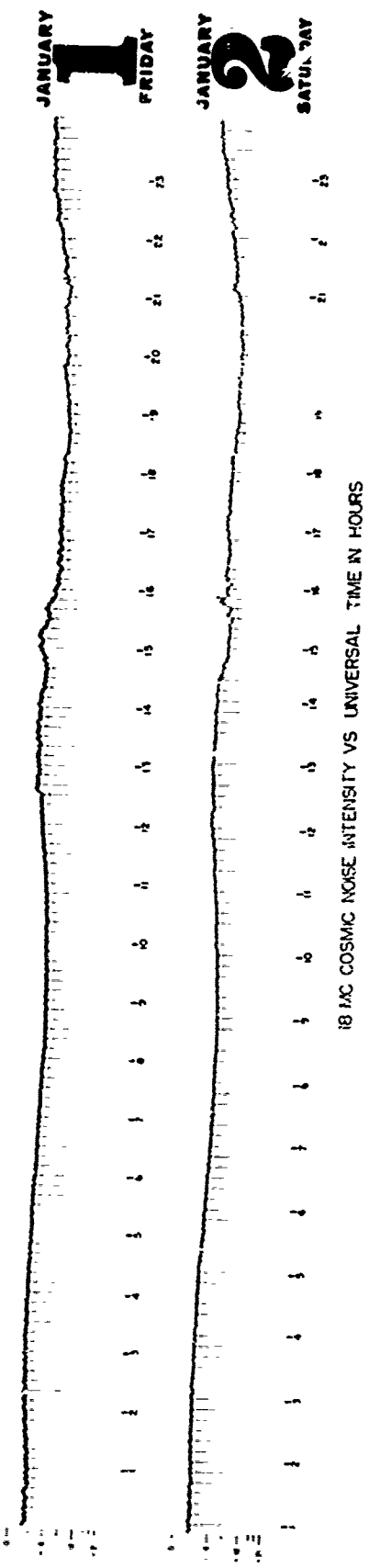
December 27	2047 - 2140	Bursts.
December 28	Large magnitude of trace variation possibly due to area storm. Freezing rain or rain all day.	
December 29	Icing on all equipment might prevent indications of small phenomena.	
	0100 - 0200	Unusually rapid drop may be continuation of variability of December 28.
	0629 - 0633	Peak, cause unknown; correlates with change in trace on most other equipment.
	1517	Equipment adjustment.
	1631 - 1635	Burst.
December 30	1433 - 1650	Variable.
	1655 - 1820	Sudden change in level, possibly caused by heavy winds.
December 31	2016 - 2050	Possible SCNA, class 1-, absorption 20%, recovery unusually slow.



18 MC COSMIC NOISE INTENSITY VS UNIVERSAL TIME IN HOURS

1960

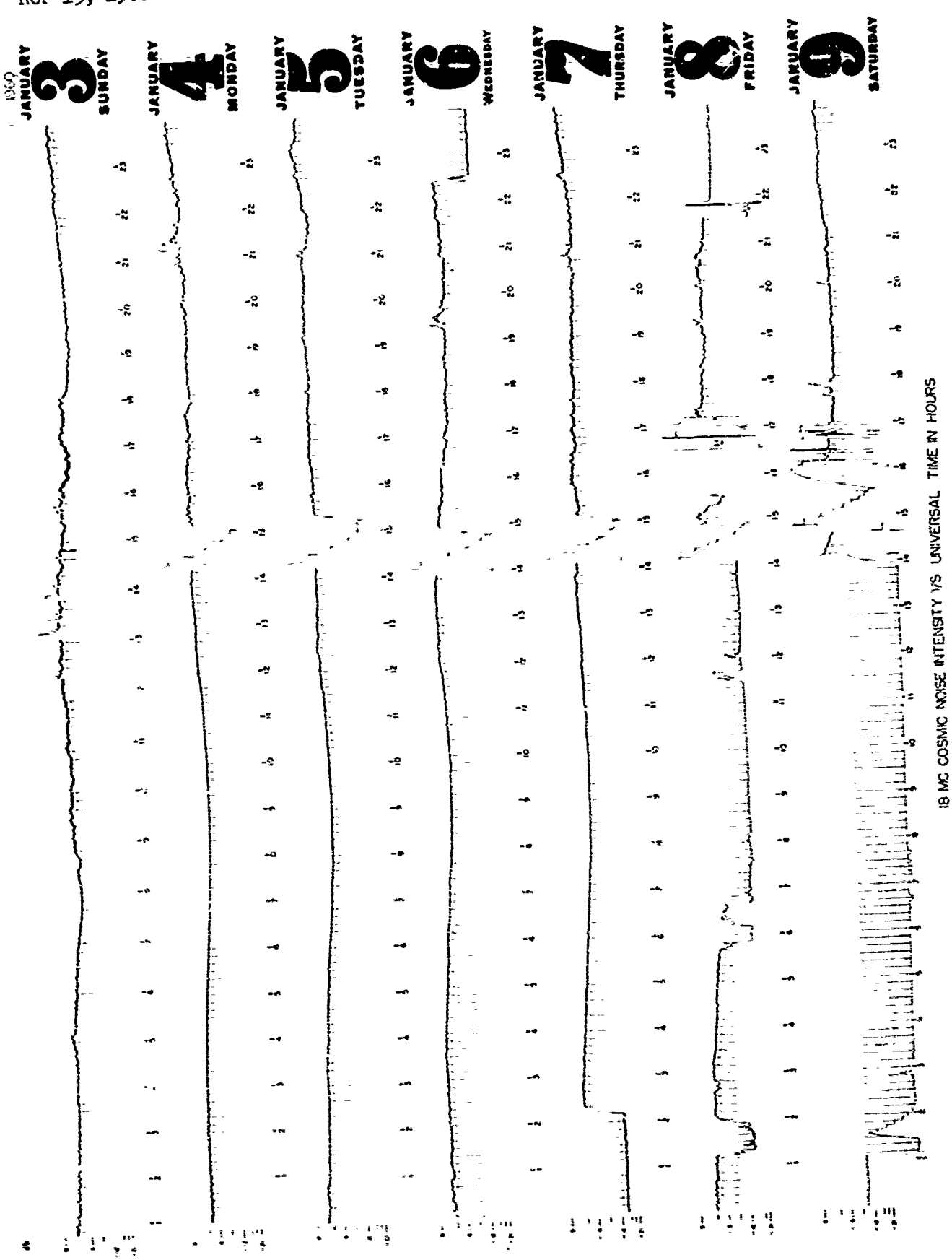
January 1	1230 - 2200	Variability, cause unknown.
January 2	Note that trace for this day begins at 0100 UT. Some ten-minute marks are farther apart than usual.	
	1422 - 1429	Equipment adjustment.
	1525 - 1612	Several bursts.


JANUARY 1 FRIDAY
JANUARY 2 SATURDAY
18 MC COSMIC NOISE INTENSITY VS UNIVERSAL TIME IN HOURS

1960

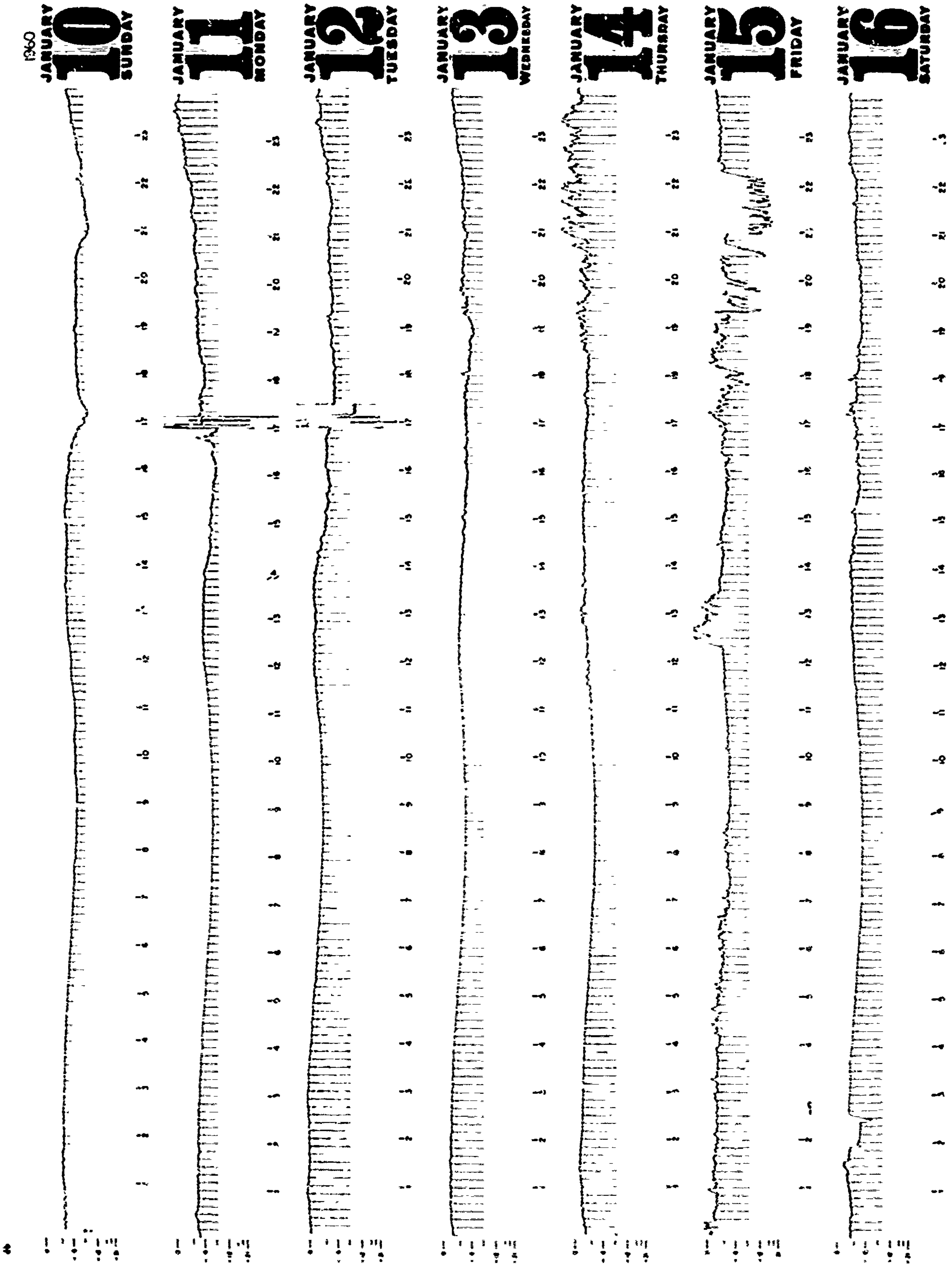
January 3	Note that trace for this day begins at 0100 UT, not at 0000 UT as usual. Some ten-minute marks are farther apart than usual.	
	1217 - 1810	Variable, correlates with strong oscillation of atmospheric pressure and atmospheric electrical potential gradient.
	1303 - 1317	Burst.
	1325 - 1329	Burst.
	1350 - 1358	Burst.
January 4	2103 - 2120	Large double burst during period of variability.
January 5	1545 - 1601	Burst.
	1758 - 1803	Burst.
	2057 - 2108	Double peak, correlates with precipitation.
January 6	1915 - 1945	Several large bursts.
	2223 - 2400	Low trace probably due to malfunction of recorder.
January 7	0000 - 0220	Low trace due to malfunction of recorder.
	2045 - 2101	Peaks, possibly due to interference.
	2224 - 2233	Peak, possibly due to interference.
January 8	0115 - 1400	Trace level low and variable, probably due to malfunction of recorder.
	1400 - 1711	Equipment adjustments.
	1911 - 1920	Peak correlates with precipitation.
	2000 - 2007	Peak correlates with precipitation.
	2038 - 2045	Peak correlates with precipitation.
	2150	Recorder not functioning properly.
January 9	0000 - 1410	Recorder not functioning properly.
	1410 - 1655	Equipment adjustments.
	1732 - 1752	Peaks, probably due to interference or malfunction of recorder.

Beginning January 6 at 2220, the trace is probably invalid and the data are of low weight.


1960
JANUARY 3 SUNDAY
JANUARY 4 MONDAY
JANUARY 5 TUESDAY
JANUARY 6 WEDNESDAY
JANUARY 7 THURSDAY
JANUARY 8 FRIDAY
JANUARY 9 SATURDAY
18 MC COSMIC NOISE INTENSITY VS UNIVERSAL TIME IN HOURS

1960

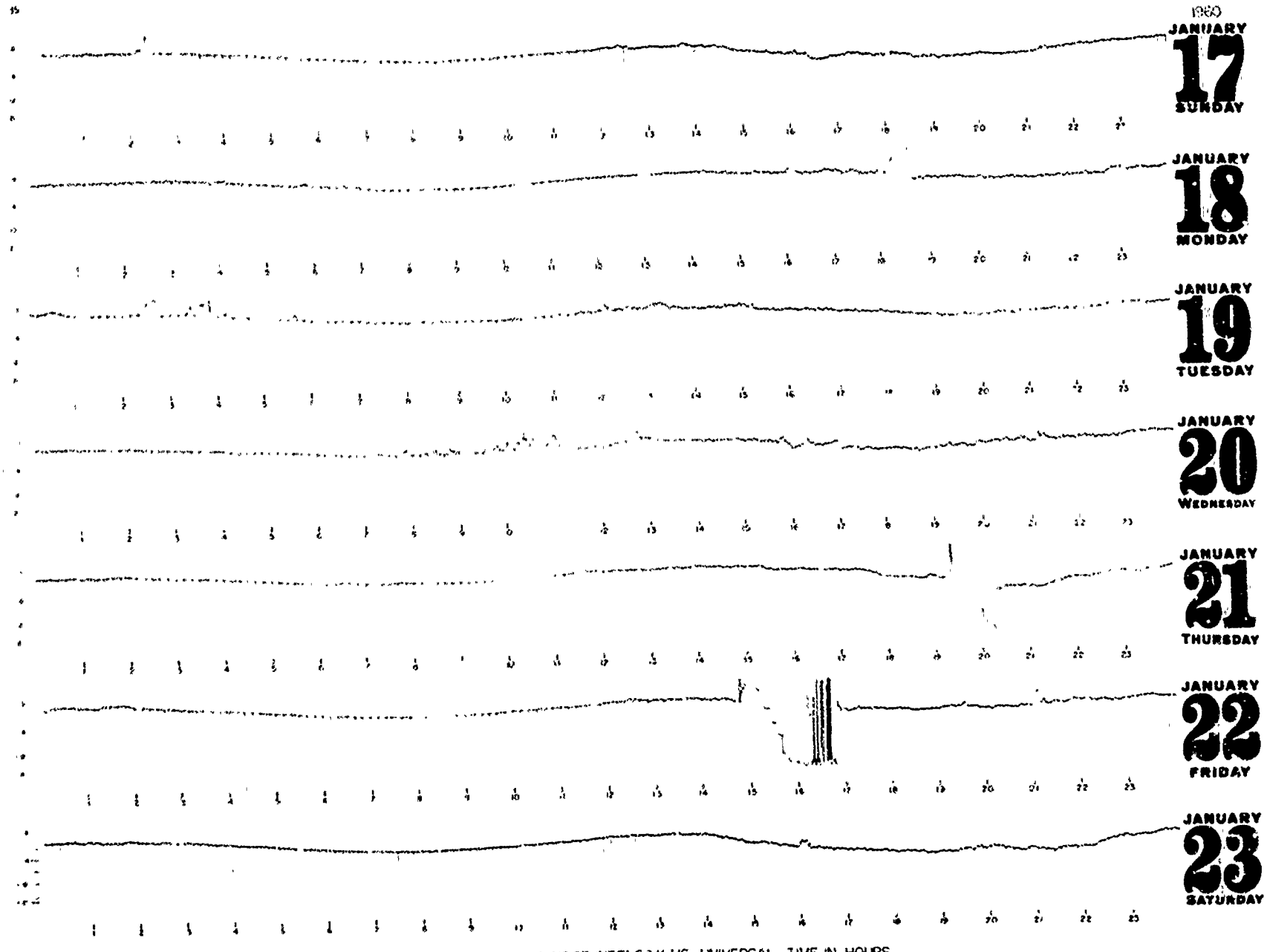
January 10	1620 - 1800	Possible slow SCNA, class 3, 69% absorption.
	2020 - 2250	Possible slow SCNA, class 2, 58% absorptic ..
	2205 - 2210	Burst.
January 11	Geophysical Alert	Number 44: Magnetic storm started January 10 at 0719.
	1641 - 1655	Possible burst.
	1701 - 1715	Gain and zero-point adjustment.
January 12	1655 - 1722	Gain and zero-point adjustment.
January 13	1800 - 1807	Possible burst.
	1915 - 2000	Variable.
January 14	Geophysical Alert	Number 45: Magnetic storm started January 13 at 1900.
	1825 - 2400	Variable.
January 15	0000 - 0850	Variable.
	1220 - 1330	Rise in level probably due to precipitation.
	1600 - 2215	Variable, correlates with pressure and atmospheric electric potential gradient fluctuations. Also, precipitation was reported from 1800 - 2000.
January 16	0122 - 0345	Variable, cause unknown.
	1712 - 1731	Peaks, cause unknown.
	1757 - 1805	Peaks, cause unknown.



18 MC COSMIC NOISE INTENSITY VS UNIVERSAL TIME IN HOURS

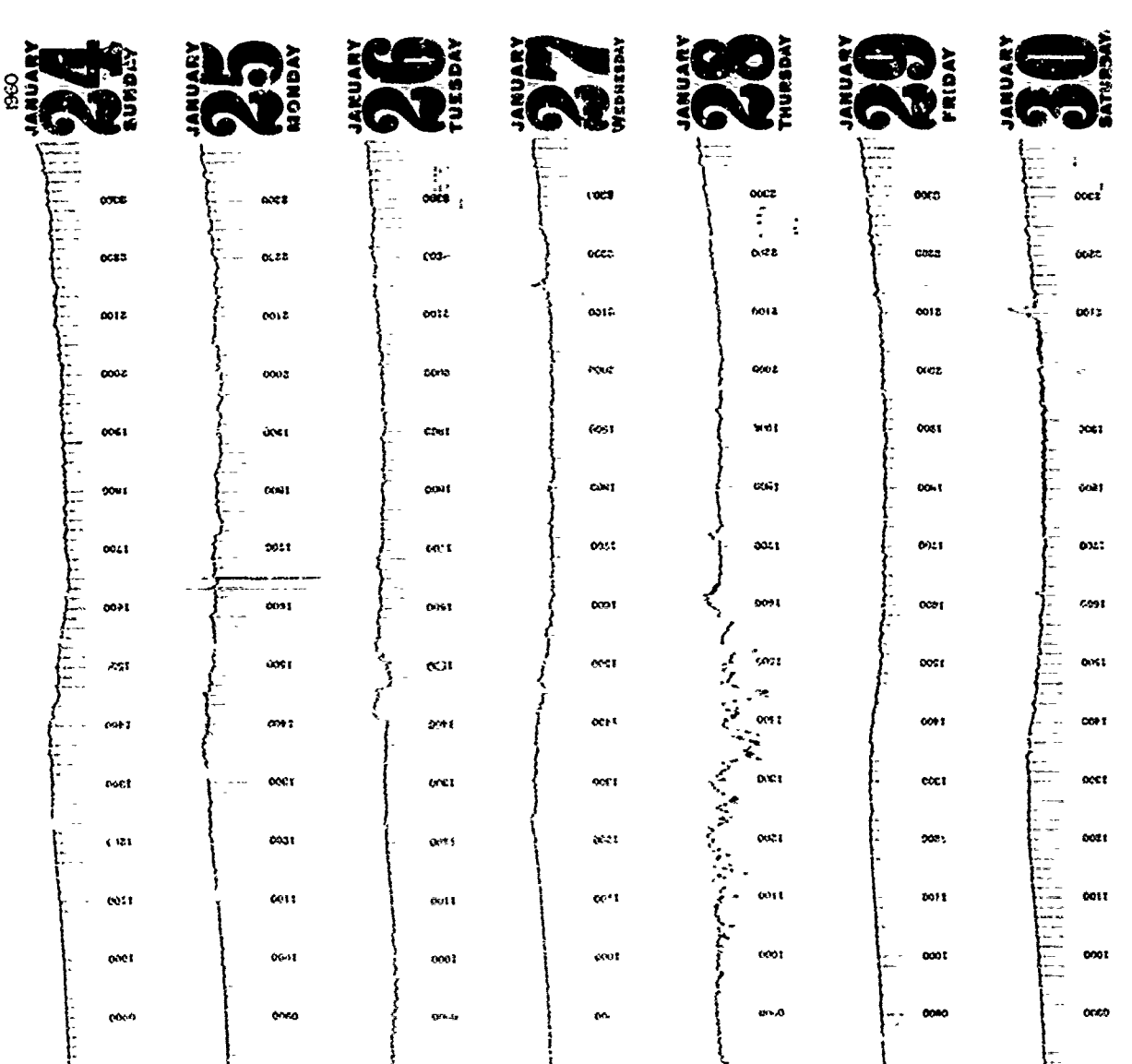
1960

January 17	0210 - 0225	Peak, cause unknown.
January 18	Geophysical Alert Number 46: Magnetic storm started January 17 at 1200.	
	1805 - 1835	Peak, caused by interference.
January 19	0223 - 0242	Peak.
	0320 - 0329	Peak.
	0332 - 0340	Peak.
	0406 - 0416	Peak.
	0630 - 0640	Peak.
	The peaks from 0223 to 0640 occur during an interval of strong variations of atmospheric electric potential gradient and atmospheric pressure, accompanied by precipitation.	
	1203 - 1211	Peak, cause unknown.
January 20	0710 - 2120	Variable.
January 21	Geophysical Alert Number 47: Magnetic storm started January 21 at 00xx.	
	2130 - 2140	Burst.
January 22	1510 - 1620	Equipment adjustments.
	2049 - 2115	Burst, correlates with dip in intensity of 27-kilocycle atmospherics.
January 23	1557 - 1612	Peak, cause unknown.



18 MC COSMIC NOISE INTENSITY VS UNIVERSAL TIME IN HOURS

1960		
January 24	No comment.	
January 25	1620 - 1631	Equipment adjustment.
January 26	1405 - 1532	Variable.
January 27	2110 - 2125	Peak, cause unknown.
January 28	0710 - 1720	Variable, accompanied by precipitation.
January 29	No comment.	
January 30	0417 - 0420	Rise in level, cause unknown.
	1608 - 1614	Peak, cause unknown.
	2051 - 2108	Burst.


1960
JANUARY 24 SUNDAY
JANUARY 25 MONDAY
JANUARY 26 TUESDAY
JANUARY 27 WEDNESDAY
JANUARY 28 THURSDAY
JANUARY 29 FRIDAY
JANUARY 30 SATURDAY
18 MC COSMIC NOISE INTENSITY VS UNIVERSAL TIME IN HOURS

1960

January 31   0810 - 1604   Chart drive not functioning properly.

ROP 15, 1960